UNIT 8 SETS AND FUNCTIONS

SHORT QUESTIONS

Q.1- Define a set and write some well-known sets of numbers.

Ans:

Set:- A collection of well defined distinct objects is called a "Set". For example a collection of students of 9th class, members of a cricket team etc.

Sets of Numbers:-

Set of Natural Numbers = N = $\{1,2,3...\}$

Set of Whole Numbers = W = $\{0,1,2,3...\}$

Set of Integers = Z = $\{...-3,-2,-1,0,1,2,3...\}$

Set of Even Numbers = E = $\{...-4,-2,0,2,4...\}$

Set of Odd Numbers = O = $\{...-3,-1,1,3,5...\}$

Set of Prime Numbers = P = $\{2,3,5,7,11,13,17...\}$

Q.2- If A = {2,3,5,7,11}
B = {1,3,5,7,9}
Find A∪B and A∩B

Solution:-

$$A \cup B = \{2,3,5,7,11\} \cup \{1,3,5,7,9\}$$
$$= \{1,2,3,5,7,9,11\}$$
$$A \cap B = \{2,3,5,7,11\} \cap \{1,3,5,7,9\}$$
$$= \{3,5,7\}$$

Q.3- **If A = {2,3,4,5}, B = {2,4,6,8}. Then find A − B and B − A.**

Solution:-

$$A - B = \{2,3,4,5\} - \{2,4,6,8\}$$
$$= \{3,5\}$$
$$B - A = \{2,4,6,8\} - \{2,3,4,5\}$$
$$= \{6,8\}$$

Q.4- **If U = {1,2,3,4,5,6,7}, A = {3,4,5}, B = {1,3,5,7} Find $(A \cup B)'$ and $(A \cap B)'$.**

Solution:-

$$A \cup B = \{3,4,5\} \cup \{1,3,5,7\}$$
$$= \{1,3,4,5,7\}$$
$$(A \cup B)' = \cup - (A \cup B)$$
$$= \{1,2,3,4,5,6,7\} - \{1,3,4,5,7\}$$
$$= \{2,6\}$$
$$A \cap B = \{3,4,5\} \cap \{1,3,5,7\}$$
$$= \{3,5\}$$
$$(A \cap B)' = \cup - (A \cap B)$$
$$= \{1,2,3,4,5,6,7\} - \{3,5\}$$
$$= \{1,2,4,6,7\}$$

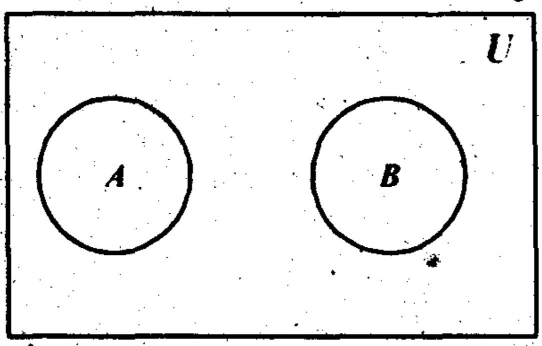
Q.5- **Show two sets A and B by Veen Diagram When.**

(i) **They are disjoint**

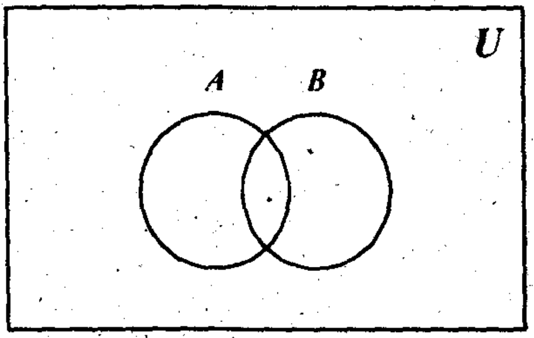
(ii) **They are overlapping**

Solution:-

(i) The figure shows that A and B are disjoint.



(ii) The figure given below shows that A and B are overlapping.



Q.6- State De-Morgan's Laws.

Ans. These laws state that

(i) $(A \cup B)^c = A^c \cap B^c$

(ii) $(A \cap B)^c = A^c \cup B^c$

Q.7- If A = {3,5,6}, B = {1,3} then find A×B and B×A.

Ans. $A \times B = \{3,5,6\} \times \{1,3\}$

$= \{(3,1),(3,3),(5,1),(5,3),(6,1)(6,3)\}$

$B \times A = \{1,3\} \times \{3,5,6\}$

$= \{(1,3),(1,5),(1,6),(3,3),(3,5),(3,6)\}$

Q.8- Defind a binary relation from a set A to set B.

Ans. If A and B are two non empty sets then any subset of $A \times B$ is called a binary relation from A to B.

Q.9- If A = {1,2,3}, B = {3,4}. Find any two binary relations from A to B.

Ans. $A \times B = \{(1,3),(1,4),(2,3),(2,4),(3,3),(3,4)\}$

$R_1 = \{(1,3),(2,4),(3,3)\}$

$R_2 = \{(1,4),(3,4)\}$

Q.10- Define Domain and Range of a binary relation.

Ans. It R is a binary relation. Then Domain of R is the set of all first elements of ordered pairs in R. The set of all second elements of ordered pairs in R is called Range of R.

Example:

$R = \{(1,3),(2,4),(3,5),(4,6),\}$

Dom R = $\{1,2,3,4,\}$

Rng R = $\{3,4,5,6,\}$

Q.11- Define a function from a set A to the set B.

Ans. Let A and B are two non empty sets and f is a binary relation fron A to B such that

(i) Domain. $f = A$

(ii) There is no repetition in the first elements of ordered pairs in f. Then f is said to be a function from A to B. It is expressed as $f: A \to B$

Q.12- Let $A = \{l, m, n\}, B = \{3,5,7\}$

Show that $f = \{(l,3),(m,3),(n,3)\}$ is a funtion from A to B.

Solution:-

(i) Domain $f = \{l,m,n\} = A$

First condition is satisfied.

(ii) All the three ordered pairs in f have different first elements and there is no repetition of first elements.

So 2nd condition is also satisfied.

Thus f is a funtion from A to B

Q.13- Define an into function?

Solution:-

Let f be a function from A to B then f is called a funtion from A into B if

Range of $f \neq B$

Example:

If $A = \{a,b,c\}$, $B = \{x,y\}$

Then $f = \{(a,x),(b,x),(c,x)\}$ is an into funtion (from A into B)

Q.14- Define an Onto function.

Ans. Let f be a function from A to B such that

Range : $f = B$.

Then f is called a funtion from A onto B.

Example:

Let $A=\{p,q,r\}$, $B=\{x,y,z\}$

Then $f=\{(p,x),(q,y),(r,z)\}$ is a funtion from A onto B

Because, Range $f=\{x,y,z\}=B$

Q.15- Define a one-one function.

Ans. Let $f:A\rightarrow B$ is a function such that second element of each ordered pairs in f is also not repeated.

Example:

$f=\{(a,x),(b,y),(c,z)\}$

It is a one-one function.

Q.16- Let $X=\{7,8,9\}$, $Y=\{d,e,f\}$ and $h=\{(7,e),(8,d),(9,f)\}$ Show that h is a one-one funtion from A onto B.

Solution:-

(i) Domain $h=\{7,8,9\}=X$

(ii) No first element is repeated in h. So h is a function from x to y.

(iii) Range $h=\{d,e,f\}=Y$

So h is an onto function.

Now again non of the second elements is repeated.

So this function is one-one function.

SOLVED EXERCISES

EXERCISE 8.1

Q.1- If $A=\{1,4,7,8\}$, $B=\{4,6,8,9\}$ and $C=\{3,4,5,7\}$ Find:

(i) $A\cup B$ (ii) $B\cup C$ (iii) $A\cap C$ (iv) $A\cap(B\cap C)$

(v) $A\cup(B\cup C)$ (vi) $A\cap(B\cap C)$

Solution:-

(i) $A\cup B=\{1,4,7,8\}\cup\{4,6,8,9\}=\{1,4,6,7,8,9\}$ Ans.

(ii) $B \cup C = \{4,6,8,9\} \cup \{3,4,5,7\} = \{3,4,5,6,7,8,9\}$ Ans.

(iii) $A \cap C = \{1,4,7,8\} \cap \{3,4,5,7\} = \{4,7\}$ Ans.

(iv) $A \cap (B \cap C) = ?$

$(B \cap C) = \{4,6,8,9\} \cap \{3,4,5,7\} = \{4\}$

Now $A \cap (B \cap C)$

$= \{1,4,7,8\} \cap \{4\} \quad \because (B \cap C) = \{4\} \quad = \{4\}$ Ans.

(v) $(A \cup B) \cup C = ?$

$(A \cup B) = \{1,4,7,8\} \cup \{4,6,8,9\} = \{1,4,6,7,8,9\}$

Now

$(A \cup B) \cup C = \{1,4,6,7,8,9\} \cup \{3,4,5,7\}$

$= \{1,3,4,5,6,7,8,9\}$ Ans.

(vi) $(A \cap B) \cap C = ?$

$A \cap B = \{1,4,7,8\} \cap \{4,6,8,9\} = \{4,8\}$

Now $(A \cap B) \cap C = \{4,8\} \cap \{3,4,5,7\} = \{4\}$ Ans.

Q.2- If $A = \{1,7,11,15,17,21\}$, $B = \{11,17,19,23\}$ and $C = \{2,3,5\}$.

Verify that: $(A \cap B) \cap C = A \cap (B \cap C)$

Solution:-

$A \cap B = \{1,7,11,15,17,21\} \cap \{11,17,19,23\}$

$A \cap B = \{11,17\}$

Now $(A \cap B) \cap C = \{11,17\} \cap \{2,3,5\}$

$(A \cap B) \cap C = \{\} = \phi \ldots(1)$

Now $B \cap C = \{11,17,19,23\} \cap \{2,3,5\} = \{\} = \phi$

$A \cap (B \cap C) = \{1,7,11,15,17,21\} \cap \phi$

$A \cap (B \cap C) = \phi \ldots(2)$

Results (1) and (2) show that

$(A \cap B) \cap C = A \cap (B \cap C)$

Q.3- If $A = \{2,4,6\}$, $B = \{3,6,9,12\}$ and $C = \{4,6,8,10\}$ verify that: $A \cup (B \cup C) = (A \cup B) \cup C$

Solution:-

$A = \{2,4,6\}$, $B = \{3,6,9,12\}$

$C = \{4,6,8,10\}$

We have to show that $A \cup (B \cup C) = (A \cup B) \cup C$

To solve the L.H.S.

$B \cup C = \{3,6,9,12\} \cup \{4,6,8,10\}$

$= \{3,4,6,8,9,10,12\}$

$A \cup (B \cup C) = \{2,4,6\} \cup \{3,4,6,8,9,10,12\}$

$A \cup (B \cup C) = \{2,3,4,6,8,9,10,12\}$ ...(1)

Now to solve the R.H.S. Consider

$A \cup B = \{2,4,6\} \cup \{3,6,9,12\}$

$A \cup B = \{2,3,4,6,9,12\}$

$(A \cup B) \cup C = \{2,3,4,6,9,12\} \cup \{4,6,8,10\}$

$(A \cup B) \cup C = \{2,3,4,6,8,9,10,12\}$ ...(2)

Results (1) and (2) show that

$A \cup (B \cup C) = (A \cup B) \cup C$

Q.4- If $A = \{2,3,5,7,9\}$, $B = \{1,3,5,7\}$
and $C = \{2,3,4,5,6\}$
verify that: $(A \cap B) \cap C = A \cap (B \cap C)$

Solution:- We are given that

$A = \{2,3,5,7,9\}$, $B = \{1,3,5,7\}$

$C = \{2,3,4,5,6\}$

We have to prove that

$(A \cap B) \cap C = A \cap (B \cap C)$

First we will solve L.H.S. Consider

$A \cap B = \{2,3,5,7,9\} \cap \{1,3,5,7\} = \{3,5,7\}$

$(A \cap B) \cap C = \{3,5\}$ ...(1)

Now we will solve R.H.S. Consider

$B \cap C = \{1,3,5,7\} \cap \{2,3,4,5,6\}$

$B \cap C = \{3,5\}$

Now $A \cap (B \cap C) = \{2,3,5,7,9\} \cap \{3,5\}$

$A \cap (B \cap C) = \{3,5\}$ ....(2)

Results (1) and (2) show that

$(A \cap B) \cap C = A \cap (B \cap C)$

Q.5- If $U = \{7,8,9,10,11,12,13,14\}$

$A = \{7,10,13,14\}$

and $B = \{7,8,11,12\}$ then

verify $(A \cap B)^0 = A^0 \cup B^0$

Solution:- We are given that

$U = \{7,8,9,10,11,13,14\}$

$A = \{7,10,13,14\}$

$B = \{7,8,11,12\}$

We are to verify $(A \cap B)^C = (A^C \cup B^C)$

To solve L.H.S.

$A \cap B = \{7,10,13,14\} \cap \{7,8,11,12\} = \{7\}$

$(A \cap B)^C = U - (A \cap B)$

$= \{7,8,9,10,11,12,13,14\} - \{7\}$

$(A \cap B)^C = \{8,9,10,11,12,13,14\}$ ...(1)

Now to solve R.H.S.

$A^c = U - A = \{7,8,9,\ldots 14\} - \{7,10,13,14\}$

$= \{8,9,11,12\}$

$B^c = U - B = \{7,8,9,\ldots 14\} - \{7,8,11,12\}$

$= \{9,10,13,14\}$

$A^c \cup B^c = \{8,9,11,12\} \cup \{9,10,13,14\}$

$A^c \cup B^c = \{8,9,10,11,12,13,14\}$ ...(2)

Results (1) and (2) show that

$(A \cap B)^c = A^c \cup B^c$

Q.6- If $U = \{4,6,8,9,10\}$ $A = \{4,6\}$ $B = \{6,8,9\}$

We are to verify De Morgans Laws

$(A \cup B)^C = A^C \cap B^C$ and $(A \cap B)^C = A^C \cup B^C$

Solution:-

First Consider $(A \cup B)^c = A^c \cap B^c$

To solve L.H.S.

$A \cup B = \{4,6\} \cup \{6,8,9\}$

$A \cup B = \{4,6,8,9\}$.

$(A \cup B)^c = U - (A \cup B)$

$= \{4,6,8,9,10\} - \{4,6,8,9\}$

$(A \cup B)^c = \{10\}$ ...(1)

Now to solve R.H.S.

$A^c = U - A = \{4,6,8,9,10\} - \{4,6\}$

$= \{8,9,10\}$

$B^c = U - B = \{4,6,8,9,10\} - \{6,8,9\}$

$= \{4,10\}$

Now $A^c \cup B^c = \{8,9,10\} \cap \{4,10\}$

$= \{10\}$ ...(2)

Results (1) and (2) show that

$(A \cup B)^c = A^c \cap B^c$

Now take De. Morgans 2nd law

$(A \cap B)^c = A^c \cup B^c$

To solve the L.H.S.

$A \cap B = \{4,6\} \cap \{6,8,9\} = \{6\}$

$(A \cap B)^c = U - (A \cap B)$

$= \{4,6,8,9,10\} - \{6\}$

$(A \cap B)^c = \{4,8,9,10\}$ ...(1)

Now

$A^c = U - A = \{4,6,8,9,10\} - \{4,6\}$

$= \{8,9,10\}$

$B^c = U - B = \{4,6,8,9,10\} - \{6,8,9\}$

$B^c = \{4,10\}$

$A^c \cup B^c = \{8,9,10\} \cup \{4,10\}$

$= \{4,8,9,10\}$ ...(2)

Results (1) and (2) show that

$(A \cap B)^c = A^c \cup B^c$

Q.7- **If** $U = \{1,2,3,4,5,6,7,8,9\}$
$A = \{2,3,6,9\}$
and $B = \{1,3,6,7,8\}$ **then**
verify $(A \cup B)^c = A^c \cap B^c$

Solution:- We are to prove that

$(A \cup B)^c = A^c \cap B^c$

To solve L.H.S.

$A \cup B = \{2,3,6,9\} \cup \{1,3,6,7,8\}$

$= \{1,2,3,6,7,8,9\}$

$(A \cup B)^c = U - (A \cup B)$

$= \{1,2,3,...9\} - \{1,2,3,6,7,8,9\}$

$(A \cup B)^c = \{4,5\}$ ...(1)

Now to solve R.H.S.

$A^c = U - A = \{1,2,3,...9\} - \{2,3,6,9\}$

$= \{1,4,5,7,8\}$

$B^c = U - B = \{1,2,3,...9\} - \{1,3,6,7,8\}$

$= \{2,4,5,9\}$

$A^c \cap B^c = \{1,4,5,7,8\} \cap \{2,4,5,9\}$

$A^c \cap B^c = \{4,5\}$ ...(2)

From (1) and (2). We get.

$(A \cup B)^c = A^c \cap B^c$

Q.8- **Fill in the blanks:**

(i)	$A \cup A =$ ______	**(ii)**	$A \cap A =$ ______
(iii)	$A \cup \Phi =$ ______	**(iv)**	$A \cap \Phi =$ ______
(v)	$\Phi \cup \Phi =$ ______	**(vi)**	$(A \cap B)' =$ ______
(vii)	$(A \cap B)' =$ ______	**(viii)**	$(A')'$ ______
(ix)	$\Phi \cap \Phi$ ______	**(x)**	$A \cap A' =$ ______

Solution:-

(i)	$A \cup A = \underline{A}$	*(ii)*	$A \cap A = \underline{A}$
(iii)	$A \cup \Phi = \underline{A}$	*(iv)*	$A \cap \Phi = \Phi$
(v)	$\Phi \cap \Phi = \underline{\Phi}$	*(vi)*	$(A \cap B)' = \underline{A' \cup B'}$

(vii) $(A\cup B)' = \underline{A'\cap B'}$ (viii) $(A')' = \underline{A}$

(ix) $\Phi\cap\Phi' = \underline{\Phi}$ (x) $A\cap A' = \underline{\Phi}$

EXERCISE 8.2

Q.1- If $A=\{3,5,6\}$, $A=\{1,3\}$, Find $A\times B$ and $B\times A$ also the domains and ranges of the two binary relations established at your own for each case.

Solution:-

$A=\{3,5,6\}$, $B=\{1,3\}$

$A\times B=\{(3,1),(3,3),(5,1),(5,3),(6,1),(6,3)\}$

$B\times A=\{(1,3),(1,5),(1,6),(3,3),(3,5),(3,6)\}$

Two binary relations in $A\times B$ are

$R_1=\{(3,1),(5,3),(5,1)\}$

$R_2=\{(3,1),(3,3),(5,3),(6,3)\}$

Dom $R_1=\{3,5\}$, Range $R_1=\{1,3\}$

Dom $R_2=\{3,5,6\}$, Range $R_2=\{1,3\}$

Two binary relations in $B\times A$ are

$R_3=\{(1,3),(1,6),(3,3)\}$

$R_4=\{(1,5),(3,5)\}$.

Dom $R_3=\{1,3\}$, Range $R_3=\{3,6\}$

Dom $R_4=\{1,3\}$, Range $R_4=\{5\}$

Q.2- If $A=\{-2,1,4\}$, then write two binary relations in a also write their domains and ranges.

Solution:-

$A=\{-2,1,4\}$

$A\times A=\{-2,1,4\}\times\{-2,1,4\}$

$=\{(-2,-2),(-2,1),(-2,4),(1,-2),(1,1)$

$(1,4),(4,-2),(4,1),(4,4)\}$

Now any subset of $A\times A$ is a binary relation in A.

Thus two binary relations are

$R_1=\{(-2,-2),(1,-2),(4,1)\}$

$R_2 = \{(-2,1),(1,1),(4,1)\}$

Dom R_1 = set of first elements of ordered pairs in R_1

$= \{-2,1,4\}$

Rang R_1 = set of 2nd elements of ordered pairs in R_1

$= \{-2,1\}$

Similarly.

Dom $R_2 = \{-2,1,4\}$, Rang $R_2 = \{1\}$

Q.3- Write the number of binary relations possible in each of following cases.

(i) In $C \times C$ when the number of elements in C is 3.

(ii) In $A \times B$ if the number of elements in set A is 3 and in set B is 4.

Solution:-

(i) Numbers of elements in $C = 3$

Numbers of elements in $C \times C = 3 \times 3 = 9$

So, number of binary relations in $C \times C$

= Number of all subsets of $C \times C$

$= 2^9$ Ans.

(ii) Numbers of elements in $A = 3$

Numbers of elements in $B = 4$

Thus Numbers of elements in $A \times B = 3 \times 4 = 12$

So, Number of all subsets of $A \times B = 2^{12}$

and number of all posible binary relations in

$A \times B = 2^{12}$ Ans.

Q.4- If. $L = \{1,2,3\}$, and $M = \{2,3,4\}$, then write a binary relation R such that

$R = \{(x,y)\, x \in L, y \in M \wedge y \leq x\}$

Also write Dom(R) and Range(R).

Solution:-

$L = \{1,2,3\}$, $M = \{2,3,4\}$

$L \times M = \{(1,2),(1,3),(1,4),(2,2),(2,3)$

$,(2,4),(3,2),(3,3),(3,4)\}$

Now $R=\{(x,y)/x\in L, y\in M \wedge y\leq x\}$

$R=\{(2,2),(3,2),(3,3)\}$

Dom(R) $=\{2,3\}$, Rng(R) $=\{2,3\}$

Q.5- If $X=\{0,3,5\}$ and $Y=\{2,4,8\}$, then establish any four binary relations in $X\times Y$.

Solution:-

$X\times Y=\{(0,2),(0,4),(0,8),(3,2),(3,4)$

$(3,8),(5,2),(5,4),(5,8)\}$

Binary relation in $X\times Y$ is any subset of $X\times Y$. So four binary relations in $X\times Y$ are.

$R_1=\{(0,2),(3,2),(5,2)\}$

$R_2=\{(0,4),(0,8),(3,2),(5,8)\}$

$R_3=\{(0,8),(3,4),(5,2)\}$

$R_4=\{(5,2),(5,4),(5,8)\}$

Q.6- If $A=\{a,b,c\}$ and $B=\{2,4,6\}$ and $f=\{(a,4),(b,4),(c,4)\}$ is a binary relation from $A\times B$ then show that "f" is a function from A into B

Solution:-

$f=\{(a,4),(b,4),(c,4)\}$

Dom $f=\{a,b,c\}=A$

Now we see that non of the 1st elements of ordered pairs in f is repeated. So f is a funtion from A to B.

Now Range$(f)=\{4\}\neq B$

It means f is a function from A into B.

Q.7- If $A=\{l,m,n\}$ and $B=\{2,4,6\}$ and $g=\{(l,3),(m,1),(n,1)\}$ is a binary relation in $A\times B$, then show that "g" is A into B function.

Solution:-

$g=\{(l,3),(m,1),(n,1)\}$

Dom $(g)=\{l,m,n\}=A$

We see that non of the first elements ordered pairs in g is repeated.

So g is a function from A to B.

Now $\text{Rng}(g) = \{1,3\} \neq B$

It shows that g is a funtion from A into B.

Q.8- If $A = \{1,3,5\}$ and $B = \{x,y,z\}$ and $g = \{(1,x),(3,y),(5,z)\}$ is a binary relation from $A \times B$, then show that "g" is A onto B function.

Solution:-

$g = \{(1,x),(3,y),(5,z)\}$

Dom $(g) = \{1,3,5\}$

Also non of 1st elemnets of ordered pairs in g is repeated. So g is a function from A to B.

Now $\text{Rng}(g) = \{x,y,z\} = B$.

It shows that g is a function from A onto B.

Review Exercise 8

Q.1- Encircle the correct answer.

(i) If A and B are two non-empty sets, then $A \cup B =$?

(a) Φ (b) $B \cup A$ (c) $A \cap B$ (d) $B \cap A$

(ii) If A and B are two non-empty overlapping sets, then $A \cap B' =$?

(a) Φ (b) $B \cap A$ (c) $A \cup B$ (d) $B \cup A$

(iii) For any two sets A and B, $A \cup B = B \cup A$ is called:

(a) Commutative law (b) Associative law

(c) De-morgan's law (d) Intersection of two sets

(iv) $A \cup (B \cup C) = (A \cup B) \cup C$ is called

(a) Commutative law (b) Associative law

(c) De-morgan's law (d) Intersection of sets

(v) If $U = \{1,2,3,4\}$, $A = \{4\}$, then $A' =$?

(a) $\{1,2,3\}$ (b) Φ (c) $\{1\}$ (d) $\{1,2,3,4\}$

(vi) If $U = \{1,2,3\}$, $A = \{1\}$, then $U - A = ?$

(a) $\{2,3\}$ (b) $\{1,2\}$

(c) $\{1,3\}$ (d) Φ

(vii) $(A \cup B)' = ?$

(a) $A' \cup B'$ (b) $A' \cap B'$

(c) $(A \cap B)'$ (d) Φ

(viii) $(A \cap B)' = ?$

(a) $A' \cap B'$ (b) $A' \cup B'$

(c) $A \cap B$ (d) $A \cup B$

(ix) If $R = \{(4,5),(5,4),(5,6),(6,4)\}$ then domain of R.

(a) $\{4,6\}$ (b) $\{4,5\}$ (c) $\{4,5,6\}$ (d) $\{5,6\}$

(x) If $R = \{(4,5),(5,4),(5,6),(6,4)\}$ then range of R is:

(a) $\{4\}$ (b) $\{5\}$ (c) $\{6\}$ (d) $\{4,5,6\}$

Ans.

(i) b	(ii) b	(iii) a	(iv) b	(v) a
(vi) a	(vii) b	(viii) b	(ix) c	(x) d

Q.2- Fill in the blanks.

(i) $(A \cup B)' =$ ________

(ii) $(A \cap B)' = ?$ ________

(iii) $A \cup (B \cup C) =$ ________

(iv) $A \cap (B \cap C) =$ ________

(v) If A and B be the two non-empty sets, then $A \cup B = B \cup A$ is called the ________

(vi) If A and B be the two non-empty sets, then $A \cap B = B \cap A$ is callede ________

(vii) Any sub-set of a cartesian product is called a________

(viii) If $R_1 = \{(1,2),(3,4),(5,6)\}$, then domain of R_1 is________

(xi) If $R_1 = \{(1,2),(3,4),(5,6)\}$, then range of R_1 is________

(x) If $f : A \rightarrow B$ then every element of a set A has its image in ________

(i) $(A'\cap B')$	(ii) $A'\cup B'$
(iii) $(A\cup B)\cup C$	(iv) $(A\cap B)\cap C$
(v) Commutative Law	(vi) Commutative Law
(vii) Binary relation	(viii) $\{1,3,5\}$
(ix) $\{2,4,6\}$	(x) Set B

Q.3- If A={1,2,3,4,5,6}, B={2,3,4,6} and C={2,3,4,7,8,9}. Verify that : $(A\cap B)C = A\cap(B\cap C)$

Solution:-

$A=\{1,2,3,4,5,6\}, B=\{2,3,4,6\}$

$C=\{2,3,4,7,8,9\}$

We have to prove that

$(A\cap B)\cap C = A\cap(B\cap C)$

To solve L.H.S

$A\cap B=\{1,2,3,4,5,6\}\cap\{2,3,4,6\} = \{2,3,4,6\}$

$(A\cap B)\cap C=\{2,3,4,6\}\cap\{2,3,4,7,8,9\} = \{2,3,4\}$ ...(1)

Now to solve R.H.S

$B\cap C=\{2,3,4,6\}\cap\{2,3,4,7,8,9\} = \{2,3,4\}$

$A\cap(B\cap C)=\{1,2,3,4,5,6\}\cap\{2,3,4\} = \{2,3,4\}$ ...(2)

Results (1) and (2) show that $(A\cap B)\cap C = A\cap(B\cap C)$

Q.4- If A={2,3,4}, B={3,6,9,12} and C={4,6,8,10}. Verify that : $A\cup(B\cup C)=(A\cup B)\cup C$

Solution:-

$A=\{2,3,4\}, B=\{3,6,9,12\}$

$C=\{4,6,8,10\}$

We have to prove that

$A\cup(B\cup C)=(A\cup B)\cup C$

To solve L.H.S

$B\cup C=\{3,6,9,12\}\cup\{4,6,8,10\} = \{3,4,6,8,9,10,12\}$

$A\cup(B\cup C)=\{2,3,4\}\cup\{3,4,6,8,9,10,12\}$

$=\{2,3,4,6,8,9,10,12\}$ ...(1)

Now to solve R.H.S

$(A \cup B) = \{2,3,4\} \cup \{3,6,9,12\}$

$= \{2,3,4,6,9,12\}$

$(A \cup B) \cup C = \{2,3,4,6,9,12\} \cup \{4,6,8,10\}$

$= \{2,3,4,6,8,9,10,12\}$ ...(2)

Results (1) and (2) show that

$A \cup (B \cup C) = (A \cup B) \cup C$

Q.5- If A={2,3,4} and B={1,3}. Find $A \times B$ and $B \times A$. Also establish two binary relations each from these cartesian products.

Solution:-

$A = \{2,3,4\}, B = \{1,3\}$

$A \times B = \{2,3,4\} \times \{1,3\}$

$= \{(2,1),(2,3),(3,1),(3,3),(4,1),(4,3)\}$

Two binary relations in $A \times B$ are

$R_1 = \{(2,1),(3,1),(4,1)\}$

$R_2 = \{(2,3),(3,1),(3,3),(4,1)\}$

Now $B \times A = \{1,3\} \times \{2,3,4\}$

$= \{(1,2),(1,3),(1,4),(3,2),(3,3),(3,4)\}$

Two binary relations in $B \times A$ are

$R_3 = \{(1,2),(1,4),(3,3)\}$

$R_4 = \{(1,3),(1,4),(3,4),(3,2)\}$

Q.6- Write the number of binary relations possible in each of the following cases.

***(i)* In $C \times C$, when the number of elements in C are 4.**

***(ii)* In $A \times B$, if number of elements in A are 2 and in B are 3.**

Solution:-

(i) Number of elements in $C = 4$

Number of elements in $C \times C = 4 \times 4 = 16$

Thus Number of all subsets of $C\times C = 2^{16}$

So Number of all Binary relaitons $= 2^{16}$

(ii) Number of elements of $A = 2$

Number of elements of $B = 3$

Number of elements of $A\times B = 2\times 3 = 6$

Thus Number of all subsets of $A\times B = 2^6 = 64$

So Number of all binary relation in $A\times B = 64$

Q.7- If $R = \{(a,b)a,b \in W, 3a+2b=16\}$. Find its domain and range R.

Solution:-

$R = \{(a,b)a,b \in W, 3a+2b=16\}$

Consider the equation

$3a+2b=16$

Put $a = 0$, 2 and 4

For $a = 0 \Rightarrow b = 8 \Rightarrow (0,8) \in R$

For $a = 2 \Rightarrow b = 5 \Rightarrow (2,5) \in R$

For $a = 4 \Rightarrow b = 2 \Rightarrow (4,2) \in R$

Now $R = \{(0,8),(2,5),(4,2)\}$

Thus

$Dom\ (R) = \{0, 2, 4\}$

$Rang\ (R) = \{2, 5, 8\}$

Multiple Choice Question

Q.1- The set $\left[\frac{p}{q} : p,q \in z \wedge q \neq 0\right]$ is the set of

(a) Real Numbers (b) Rational Numbers

(c) Irrational Numbers (d) Prime Numbers

Q.2- Zero = 0 , is

(a) An even number (b) Odd numbers

(c) Imaginary numbers (d). Irrational numbers

Q.3- $A \cup B =$

(a) $\{x / x \in A \vee x \in B\}$ (b) $\{x / x \in A \wedge x \in B\}$

(c) $\{x / x \in A \wedge x \notin B\}$ (d) $\{x / x \notin A \wedge x \in B\}$

Q.4- The set $\{x / x \in U \wedge x \notin A\}$ is equal to

(a) A (b) A^c (c) A' (d) $A - B$

Q.5- The set $\{x / x \in A \wedge x \notin B\}$ is equal to

(a) A^c (b) B^c (c) $A - B$ (d) $B - A$

Q.6- $A \cup (B \cup C) = (A \cup B) \cup C$ is the law

(a) De Morgan (b) Commutative

(c) Associative (d) Distributive

Q.7- In the venn diagram two sets A and B are such that

(a) $A \subseteq B$ (b) $B \subseteq A$ (c) Overlapping (d) Disjoint

Q.8- The statement $(A \cup B)^c = A^c \cap B^c$ is of

(a) Distributive law (b) Associative law

(c) De-Morgans law (d) Commutative law

Q.9- If $A = \{1,2,3,4,5,6\}$ and $U = \{1,2,3...10\}$

Then A^c is equal to

(a) $\{2,4,6,8,10\}$ (b) $\{1,3,5,7,9\}$

(c) $\{7,8,9,10\}$ (d) $\{1,2,3,4\}$

Q.10- If $A = \{1,2,3\}$, $B = \{y,z\}$, then all the binary relations in $A \times B$ are

(a) 6 (b) 9 (c) 32 (a) 64

Q.11- $R = \{(1,2),(1,3),(2,5),(3,10)\}$ is a binary relations. Its Domain is

(a) $\{1,1,2,3\}$ (b) $\{1,2,3\}$

(c) $\{2,3,5,10\}$ (d) $\{1,2,3,5,10\}$

Q.12- If $A = \{a,b\}$, $B = \{x,y\}$, Then the function from A onto B is

(a) $\{(a,x),(b,x)\}$ (b) $\{(b,x), (a,y)\}$

(c) $\{(a,x), (a,y)\}$ (d) $\{(b,x),(b,y)\}$

Q.13- If f is a function from A to B such that Rang F = B Then it is a function

(a) Into (b) Onto

(c) One-One (d) Correspounding

Q.14- A one-one and onto function is called

(a) Injective (b) Surjective

(c) Bijective (d) Objective

Q.15- If A and B are disjoint sets then

(a) $A \cap B' = \Phi$ (b) $A \cup B = \Phi$

(c) $A^c = B$ (d) $B^c = A$

MODEL CLASS TEST

Time : 40 mins Max Marks : 25

Q.1- Tich the best choice.

(i) The law $A \cup B = B \cup A$ is called

(a) De-Morgan (b) Associative

(c) Commutative (d) Distributive

(ii) If $R = \{(1,3),(1,4),(2,3)\}$ Then $Dom(R) =$

(a) $\{1,1,2\}$ (b) $\{1,2\}$

(c) $\{3,3,4\}$ (d) $\{3,4\}$

(iii) If "f" is a function , such that non of 2nd element of ordered pairs in f is repeated. Then f is called

(a) Onto (b) into (c) One-One (d) Bijective.

(iv) Complement of universal set is equal to

(a) Universal set (b) Empty set

(c) Sub set (d) Super set

(v) $(A \cup B)^c$ is equal to

(a) $A^c \cup B^c$ (b) $(A \cap B)^c$

(c) $A^c \cap B^c$ (d) Φ

(vi) $A \cup \Phi$ is equal to .

(a) A (b) Φ (c) $A \cap \Phi$ (d) A^c

(vii) $\{2,4\} \cap \{1,3,5\}$ is equal to

(a) $\{3\}$ (b) $\{1,2,4\}$ (c) Φ (d) $\{1,2,3,4,5\}$

Q.2- Attempt any five of the following short questions.

(i) If $A = \{a,b,c\}$ and $B = \{a,e,i,o,u\}$

Then find $A \cup B$ and $A \cap B$

(ii) If $U = \{1,2,3,...10\}$ and $A = \{1,2,3,4\}$

Then find A^c

(iii) If $U = \{1,2,3,...10\}$ and $B = \{1,2,3,4\}$

Then find $B \cup B^c$

(iv) If $R = \{(1,5),(2,6),(2,7),(3,7)\}$

Then find Dom(R) and Rng(R)

(v) If $A = \{5,6,7\}$, $B = \{1,2\}$ Then find the function from A onto B

(vi) If $A = \{a,b,c,d\}$ and $B = \{1,3\}$

Write a binary relation from A to B which is not a function.

Attempt any two of the following questions.

Q.3- If $U = \{1,2,3,...9\}$, $A = \{2,3,6,9\}$, $B = \{1,3,6,7,8\}$

Then verify $(A \cup B)^C = A^C \cap B^C$

Q.4- If $A = \{2,3,5,7,9\}$, $B = \{1,3,5,7\}$, $C = \{2,3,4,5,6\}$

Then verify $(A \cap B) \cap C = A \cap (B \cap C)$

Q.5- If $A = \{1,3,5\}$, $B = \{2,4,6\}$ Then find $A \times B$ and a b injective function from A to B.